ORIGINAL

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
Service Rules for the 746-764 and	)	
776-794 MHz Bands, and	)	WT Docket No. 99-168
Revisions to Part 27 of the	)	
Commission's Rules	)	

OPPOSITION OF
ADAPTIVE BROADBAND CORPORATION

Adaptive Broadband Corporation ("ADAP"), by its attorneys and pursuant to Section 1.429 of the Commission's Rules, 47 C.F.R. §1.429(f), hereby opposes the August 11, 2000 petition of Motorola for reconsideration or clarification ("Petition") of the Commission's *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking ("MO&O")* in the above-captioned proceeding.[1] In its Petition, Motorola asks the Commission to reconsider its decision to permit the deployment of base stations in the 777-794 MHz band on the grounds that such deployment would result in additional interference for public safety operations. As shown below, there is no merit to Motorola's argument. Grant of Motorola's request would simply limit the availability of services employing effective and efficient technologies such as time-division duplexing ("TDD") to the ultimate detriment of U.S. consumers. As such, Motorola's Petition should be denied.

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[1] *In Re Service Rules For the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking,* WT Docket No. 99-168, FCC 00-224, rel. June 30, 2000.

Motorola's entire argument is based on a brief technical analysis provided in Attachment B to the Petition. According to Motorola, this analysis demonstrates that a base station operating in the upper band will degrade public safety fringe area coverage by providing at least a 1 dB rise in the noise floor even when separated from a public safety base station receive site by as much as 4.8 kilometers (3.0 miles).[2] However, Motorola's calculations for the required separation distances between commercial and public safety base stations use very simple but generally invalid formulations. As explained in Annex 1, Motorola assumes that an unreasonably low level of interference into any weak signal constitutes undue interference into public safety operations.[3] Motorola also assumes that commercial base station antennas are placed at a height that tends to maximize the potential for interference into public safety operations but does not reflect the actual practices of the industry regarding antenna placement. Finally, Motorola's analysis employs a formula, the free-space propagation formula, that is simple to use but not valid for the particular circumstances at hand. The net result of Motorola's choice of assumptions and formula is that Motorola has postulated a scenario that is, in theory, the worst case possible. However, the scenario Motorola postulates is, at the same time, highly improbable.[4]

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2 Petition at 6.

3 Specifically, Motorola uses as a threshold criterion an interference level from commercial base stations of 6 dB below the public safety base station receiver's internal noise level, which would cause a 1 dB rise in that receiver's effective noise floor.

4 Furthermore, Motorola fails to explain why interference conditions introduced by the operation of base stations in the 777-792 MHz band are not satisfactorily addressed by the uniform 76 + 10 log P out-of-band emission ("OOBE") limit that is applied to fixed stations operating in this band. Rather, Motorola simply restates its previously rejected complaint that this OOBE limit is not good enough. *See* Petition at 7, n.17.

The Commission recognized in its *First Report and Order*[5] that it must strike a "reasonable balance" between protecting public safety and maintaining the commercial viability of the 700 MHz band in establishing technical rules for these frequencies. Prohibiting the use of base stations in the upper band as proposed by Motorola does not strike such a "reasonable balance" in view of the flaws in Motorola's supporting analysis. Rather, such action would only serve to limit unnecessarily the ability of 700 MHz licensees to deploy TDD technology. In turn, U.S. consumers would be deprived of new and innovative services that make use of TDD.

In light of these facts, grant of Motorola's Petition to prohibit the operation of base stations in the upper 700 MHz band cannot be found to serve the public interest. The Commission should deny Motorola's Petition.

Respectfully submitted,

ADAPTIVE BROADBAND CORPORATION

By: 

Joan M. Griffin
KELLEY DRYE & WARREN LLP
1200 19th St. NW, Suite 500
Washington, DC 20036
(202) 955-9600

Kenneth J. Wees
Vice President, General Counsel & Secretary
ADAPTIVE BROADBAND CORPORATION
1143 Borregas Ave.
Sunnyvale, CA 94089

Its Attorneys

September 15, 2000

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5 *See In Re Service Rules For the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, First Report and Order,* WT Docket No. 99-168, FCC 00-5, rel. Jan.7, 2000, at ¶ 104. The FCC effectively recognized in its *First Report and Order* that protecting public safety cannot mean guaranteeing that there will never be any interference under any circumstance between commercial and public safety licensees, as such guarantees are not possible even with the most stringent technical rules. *See Id.*

TECHNICAL RESPONSE TO MOTOROLA'S PETITION ON 700 MHz RULES

Summary

Motorola's Petition for Reconsideration or Clarification attempts to make a case for unanticipated and excessive "potential" interference from TDD operation to Public Safety licensees in the 700 MHz band. In so doing, they rely on a technical showing employing the so-called free-space propagation formula. Further, they base the potential existence of interference on a criterion of an interfering level 6 dB below the threshold level, often called the minimum discernible signal (MDS) level, and make certain implicit assumptions regarding the commercial base station antenna height.

We show, in this Response, that the use of the free-space propagation formula is inappropriately used. Further, we show that Motorola's use of a 6 dB below threshold criterion for fringe area interference threshold is likewise inappropriate, given that no communications system in this band would actually operate with threshold signals. Finally, we show that Motorola's assumption regarding antenna heights is not justified.

Discussion

Fringe Area Signals

In their Appendix B, Motorola attempts to show that out of band emissions from a commercial base station, meeting current Part 27 rules, would adversely affect reception of a mobile public safety transmitter located in a fringe area. Motorola defines a fringe area signal in their Appendix A as being *any* weak signal. In Appendix A at page 6, Motorola uses as a threshold criterion an interference level from commercial base stations of 6 dB below the public safety base station receiver's internal noise level, which would cause a 1 dB rise in that receiver's effective noise floor.

There will always be some signals that are on the edge of intelligibility, and for which a 1 dB change in receiver effective noise floor might render them unintelligible. But surely, public safety communications systems will be designed with adequate safety margins so that transmissions within their designed coverage area will not be received at threshold levels. If not, they should be. It is also somewhat disingenuous to suggest that a 1 dB rise in noise threshold will necessarily disrupt communications. A pathological case can always be constructed for which this may be true, but for the vast majority of situations, no effect at all on communications would be observed.

The real utility of using a rise in noise threshold for interference calculations is that it is simple, not that it is necessarily representative. In fact, for the digital modulation transmissions required for public safety systems operating under Part 90 Subpart R rules, the effect of a slight increase in receiver noise floor due to out of band emissions from a commercial operator may be completely inconsequential. In any event, the relationship between receiver noise floor and communications performance, properly characterized for digital modulation as a corrected bit error rate (after forward error correction or other coding), is *not* simple.

Line of Sight assumption may not be justified

Motorola's stated concern is for "Interference from Cellularized Commercial Systems Into Public Safety Systems."[6] In its analysis, Motorola makes the assumption that commercial base station antennas are in line of sight to public safety base stations.[7] However, as is well known, cellular system base antennas are not installed "as high as possible" (305 meters above average terrain in the case of Part 27 rules). They are installed at a height adequate to provide service to a limited cell area, and to minimize overshoot into other cells which may be reusing the same frequency plan. Intervening terrain features also play a part. These same factors may minimize interference to public safety base stations, as well.

Free Space Propagation Formula is simple, but not valid

The free space propagation formula is derived from simple geometric considerations and accounts *only* for the spreading out of energy as a signal is radiated from an isotropic antenna.[8] It accounts for *no* other real-world considerations.

The free space propagation formula is generally held to be completely valid only for satellite communications paths.[9] For terrestrial propagation, the free space formula is sometimes modified by the addition of a so-called "clutter factor" $L_{clutter}$ into the equation in an attempt to force-fit it into a situation for which it does not really apply. This is, in fact, shown by Motorola in their equation 3 of Appendix A. On page 6 of their Appendix A, Motorola ascribes a value of 5 dB to $L_{clutter}$., which is, arguably, too low. Without explanation, however, Motorola in the present Appendix B, on page B-2, has used a clutter factor $L_{clutter}$ of 0 dB. A zero dB clutter factor removes it from the equation.

We suspend for a moment our objections to the free space formula, and allow that for very short distances it may adequately represent the situation if there are no obstructions.

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[6] Title of Motorola's Appendix A.

[7] Appendix B, page 2, "For base-to-base propagation we assume line-of-site (sic) conditions.."

[8] The isotropic antenna is one which radiates equally in all directions (spherical) but does not exist in the real world. It is a convenient, and useful, mathematical fiction.

[9] Collins, Gerald W., "Wireless Wave Propagation", Microwave Journal, July 1998, at 78 ("Free-space propagation is encountered only in rare instances such as satellite-to-satellite paths. In typical terrestrial paths, the signal is partially blocked and attenuated due to urban clutter, trees and other obstacles"); Lee, William C.Y., *Mobile Communications Engineering*, McGraw Hill, 1982, at 118 ("In the real mobile-radio communications environment the true free-space transmission path found in the space-communications environment does not exist"); *Engineering Considerations for Microwave Communications Systems,* GTE Lenkurt Incorporated, 1970, at 34 ("Free space loss is defined as the loss that would obtain between two isotropic antennas in free space, where there are no ground influences or obstructions; in other words, where blocking, refraction, diffraction and absorption do not exist").

If we recalculate the separation distance calculation in Motorola's Appendix B using a clutter factor of 5 dB, the separation distance is almost halved, from 0.60 km to 0.34 km, or 340 meters. This is for Motorola's initial case of 0 dBi antenna gains.

Motorola then proceeds to calculate separation distance using antenna gains of 5 dBi for the public safety base station receiver antenna, and 12.15 dBi for the commercial base station transmitting antenna. Again using the free space formula, Motorola, not surprisingly, obtains a much larger distance. But this compounds the error of using a free space formula in the first place, because the larger the distance, the more likely that there are obstructions, and the more misleading (always on the side of a longer distance) a free space calculation will be.

Conclusion

Motorola has presented calculations for required separation distances between commercial and public safety base stations. These calculations make use of very simple, but generally invalid formulations. At best, Motorola can be said to have demonstrated a barely theoretically possible worst-case scenario which is, at the same time, highly improbable.

ENGINEERING CERTIFICATE

1. I am Jacob Z. Schanker, P.E. I am Director of Agency Compliance for Adaptive Broadband Corporation. I received the B.E.E. and M.E.E. degrees from the City University of New York. I am a licensed Professional Engineer in the State of New York, and a Chartered Professional Engineer (CPEng) in Australia.
2. I have read the foregoing "Opposition of Adaptive Broadband Corporation" and the technical statements made therein are true to the best of my knowledge and belief.

Jacob Z. Schanker
September 15, 2000

CERTIFICATE OF SERVICE

I, Pamela L. Murray, do hereby certify that on this 15th day of September 2000, a copy of the foregoing Opposition of Adaptive Broadband Corporation was served by U.S. first class mail, postage prepaid, on the following parties:

Leigh M. Chinitz
Manager
Telecommunications Strategy
and Spectrum
Motorola, Inc.
1350 I Street, NW., Suite 400
Washington, D.C. 20005

Richard C. Barth, PhD
Vice President and Director
Telecommunications Strategy
and Regulation
Motorola, Inc.
1350 I Street, NW., Suite 400
Washington, D.C. 20005

Pamela L. Murray